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THE ROLE OF PRESUPPOSED AND FOCAL INFORMATION IN INTEGRATING SENTENCES

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TRAINING TECHNICAL AREA

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Two experiments explored the linguistic processes that underlie integration of the meaning of one sentence with the meaning of another. The authors propose that the linguistic markings of both a referring anaphor and the antecedent to which it refers are important for comprehension. The integrating process involves identifying a primary antecedent from a context sentence and relating an appropriately marked anaphor from the target sentence back to the antecedent. The primary antecedent is ideally marked as focal (new information) in the context sentence, whereas the anaphor is linguistically

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presupposed (old information) in the target sentence. Two comprehension-time experiments tested this idea. Subjects read sentence pairs in which the linguistic markings of a repeated noun phrase varied across the sentences. Context sentences incorporated the noun phrase as either presupposed (P) or focal (F), and the target repetition appeared as either presupposed (P) or focal (F). Comprehension time was fastest for FP combinations, intermediate for FF and PP pairs, and slowest for PF combinations. These results obtained when the proximity of the repeated phrase was controlled (Experiment I) and also when target sentences were in both active and passive voices (Experiment II).

This report is intended for psychologists interested in linguistics.

Technical Paper 364

THE ROLE OF PRESUPPOSED AND FOCAL INFORMATION IN INTEGRATING SENTENCES

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FOREWORD

The Training Technical Area of the Army Research Institute for the Behavioral and Social Sciences (ARI) conducts a program of research in support of the systems engineering of training. A major objective of this research is to develop the fundamental data and technology necessary to field integrated systems for improving individual job performance. Such systems include Skill Qualification Testing (SQT), job performance aids, and training courses both in schools and in the field.

This report summarizes two experiments designed to assess factors that underlie the comprehensibility of written training materials. The research was in response to a question that continually confronts officials at the Army Training and Doctrine Command (TRADOC): "How can training materials be designed to convey important information in language that is easy to understand?" The present work was a joint effort of colleagues from ARI and Arizona State University. It represents a basic research effort completed under Army Project 2Q161102B74F, FY 1978.

The authors thank Dr. Leon Manelis, Illinois State University, and Mrs. Doris Clapp for their comments on an earlier draft of the paper.

JOSEPH ZEIDNER
Technical Director

THE ROLE OF PRESUPPOSED AND FOCAL INFORMATION IN INTEGRATING SENTENCES

BRIEF

Requirement:

To identify factors that affect the comprehensibility of written materials and to develop guidelines that writers can use to make texts easier to understand.

Procedure:

Adult subjects read 50 two-sentence texts, presented by tachistoscope, controlling the initiation and ending of each pair of sentences. The time they required to understand each second sentence in relation to the first (integration) was measured.

One experiment varied the linguistic characteristics of information common to both sentences of a pair. For some pairs, the common information was linguistically marked as "old" (presupposed) in both sentences; for some pairs, the common information was identified as "new" (focal) in both. Some pairs linguistically identified the common information as new in the first sentence and as old in the second, and some reversed the marking, identifying the common information as old in the first and new in the second. As a control condition, some sentence pairs had no information in common. Sentence sets combined these five conditions; that is, five separate first sentences were constructed representing the five conditions, and each was paired with a specific second target sentence. This technique assured that variations in target reading time were a direct function of the first sentence of the pair.

Additional experimentation varied the proximity of the common information across the two sentences (Experiment I) and used different syntax in the target sentences (Experiment II).

Findings:

The linguistic characteristics of the common information affected comprehension in consistent ways. Essentially, comprehension was fastest when the common information was introduced as focal in the first sentence and then repeated as a presupposition in the second sentence. When the common information across sentences occupied only one of these two linguistic positions, comprehension was significantly slower. Finally, when the common information was introduced as

presupposed in the first sentence and then used as a focus in the second, comprehension was still slower. The last condition was as slow as the control condition (two disconnected sentences). This general pattern held for texts of various lengths and for sentences with varied syntax.

Implication of Findings:

These experiments demonstrate that the comprehensibility of written materials is partly a function of the linguistic characteristics of the text. Results suggest that important information should be emphasized by introducing that information with specific linguistic conventions. Otherwise, the reader may misinterpret the intended theme and consequently not comprehend the meaning.

THE ROLE OF PRESUPPOSED AND FOCAL INFORMATION IN INTEGRATING SENTENCES

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THE ROLE OF PRESUPPOSED AND FOCAL INFORMATION IN INTEGRATING SENTENCES

INTRODUCTION

The syntactic structure of an utterance helps to define which elements of a sentence are conveyed as old information and are marked as new. The terms old information and presupposition refer to that part of a sentence (i.e., an argument or a proposition) that a speaker/writer assumes a listener/reader knows about or takes for granted.[1] For instance, in the following sentence,

1. The one who slapped Wally was Morris,

the speaker assumes that the listener already knows that someone slapped Wally. Thus, the proposition (SLAP, SOMEONE, WALLY) represents presupposed or old information. Focal information, on the other hand, refers to an element that receives intonational stress by the speaker and conveys new information. In the sentence above, the speaker asserts or focuses on the identity of the person who slapped Wally, namely Morris.[2]

In written communication, presupposed and focal markings generally occur at predictable positions in a sentence. Information toward the beginning of a sentence (e.g., the grammatical subject) is usually presupposed, whereas focal information normally appears near the end of a sentence (e.g., the direct object in a transitive sentence). The presuppositional-focal markings within a sentence are indeed real psychologically. Subjects answer questions using sentence structures that complement the presupposition-assertion relation of the question itself (Bock, 1977; Tannenbaum & Williams, 1968). Similarly, subjects reliably use old and new information differentially to verify the truth value of relations between sentences and pictures (Carpenter & Just, 1977; Hornby, 1974).

The present study investigated the role of presupposed and focal information in integrating sentences. Specifically, the experiments

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[1] The text analysis used in this paper corresponds to Kintsch's (1974) system. His analysis system uses propositions as the basic unit of analysis. Predicators and arguments are components of propositions: Predicators are concepts that express relations, and arguments are concepts that provide referential information.

[2] Throughout this paper we use the terms presupposition, given information, and old information synonymously; focus, assertion, and new information are also used synonymously. Although there are nuances of meaning associated with each term, the present degree of precision does not require that such distinctions be made.

reported here introduced and tested an idea derived from the theory of sentence integration proposed by Clark and his colleagues (Carpenter & Just, 1977; Clark & Haviland, 1974, 1977; Haviland & Clark, 1974). According to the "given-new" strategy a sentence is integrated into memory in a three-step process. Beginning with Stage 1, the incoming sentence is broken into its respective given (presupposed) and new (focal) components. During Stage 2, memory is searched for an antecedent that matches the given information. Finally, in Stage 3 (assuming the antecedent is found), the new information is integrated in memory by appending it to the representation that contained the antecedent. Of course, if no antecedent is in memory, some form of bridging is necessary for integrating the new information.

The primary evidence for Clark's theory has been gathered using a comprehension paradigm. Typically, a subject is presented with two sentences, a context sentence and a target sentence, in that order, and is instructed to read the target sentence with the intent of relating its content to the context sentence. The sentences are constructed so that the presupposed information in the target sentence either does or does not have a direct antecedent provided by the context sentence. In accordance with given-new predictions, comprehension time of the target sentence varies as a function of the presence or absence of a clearly defined contextual referent (Haviland & Clark, 1974; Yekovich & Walker, 1978).

Although the given-new theory provides a conceptual framework for sentence integration, many aspects of the integrative process are not detailed. As an illustration, consider the following possible sentence pairs. (Sentences 2 and 3 are context sentences.)

2. In the marketplace, the traitor warned the Arab about the ambush.

3. Outside the tent, the Arab slung the rifle over a shoulder.

Target sentence: The Arab rode the camel through the village.

Sentences 2 and 3 each contain the definite referent, the Arab, and thus when either sentence is presented as a context, the resulting memory structure will contain a direct antecedent. Presumably, then, integrating the target sentence with either context sentence should be a relatively straightforward processing task. Notice however, that in sentence 2, the Arab is focal information whereas in 3 that noun occurs as a presupposed argument.[3] Does this difference influence the comprehensibility of the target sentence, or are context sentences 2 and 3 equally effective as integrative agents? In its present form, the given-new model has

[3]It is generally held that the presupposition in a sentence consists of one or more predicator-argument relational structures. The present discussion focuses on only the argument portion of these relational structures.

has no transparent way of dealing with such a question. Although the theory outlines a general memory search process (Stage 2), it does not provide the theoretical machinery for evaluating whether the linguistic marking of a contextual antecedent affects that search process. The present experiments were concerned with testing the plausibility of this linguistic effect.

Our basic proposal is that information presented in context sentences is not processed neutrally. Rather, we believe that incoming information is processed and interpreted in such a way that a reader develops expectations about what can logically come next. This expectation by the reader complements the writer's intent of communicating in accordance with conversational rules and postulates (Clark & Haviland, 1977; Grice, 1975). We suggest further that the linguistic properties of context information influence in a general way the reader's expectation about subsequent content. In essence, the linguistic structure biases the reader's interpretation by differentially marking the sentence elements. Although not clairvoyant, the reader does use certain linguistically marked information in the context sentence to adjust expectations about a subsequent statement.

For present purposes we are going to argue that presupposition and focus are two contextual markings that operate differently in guiding the integration of two sentences. The primary argument is simple. The reader's task is to relate several pieces of incoming information. When an introductory sentence is input, the reader identifies the presupposition and the focus on the basis of syntax. In the absence of extralinguistic context, the new information is more heavily marked than the presupposition, and so the reader focuses on that element. In a sense, this focusing evokes a minimal expectation that subsequent information should be related in some way to that focal point. In other words, the focus in the context sentence becomes the primary potential antecedent. Input of the second sentence causes the reader to dissect that information into its given and new components and subsequently to compare those elements with the primary antecedent. If a match occurs (i.e., if the relation between antecedent and anaphor is satisfied), the second sentence can be related easily to the first. However, if no element in the second statement matches the original focus, the reader must reinterpret the context sentence and check for other possible referents.[4]

The foregoing ideas point directly to the importance of contextually marked information in the integrative process. However, we do not want to ignore the contribution of the linguistic structure of

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[4]This discussion is intended for the two-sentence case where the first sentence introduces a concept and the second sentence provides elaboration of that concept. Consideration of the linguistic operators involved in integrating additional material is beyond the scope of this paper.

target information. (For further discussion, see Carpenter & Just, 1977.) Rather, we suggest that the linguistic markings of both the context sentence and the target sentence contribute to successful integration. In simple terms, the context contributes some appropriately (or inappropriately) marked information, and the target complements with a correctly (or incorrectly) marked anaphor. Presumably, if either the context or the target fails to mark the relevant integrative agent appropriately, comprehension will suffer.

The following sentences illustrate how context and target markings jointly influence the comprehension process. (Sentences 4 through 7 are context sentences.)

4. The vandals started the fire in the basement with kerosene.

5. In the hotel, the fire awakened Albert from a nap.

6. In the hotel, the vandals doused the room with kerosene.

7. In the basement at the arsenal the room contained explosives.

Target sentence: The fire filled the room with smoke.

Sentence 4 is a context that appropriately marks the fire as a focal element. When this contextual focus is coupled with the presupposed noun, the fire, in the target, an appropriate pair of markings result for the sentences (FP). In other words, the sentence pair involving 4 has TWO appropriate markings for the repeated phrase. Sentence 5 marks the fire as presupposed, and, consequently, when 5 is coupled with the target, only the target presupposition serves as an appropriately marked noun (PP). This partial condition can be typified by ONE appropriate marking. Similarly, sentence 6 contributes the correctly marked noun, the room, as a focal element, but that noun is mismarked as a focal element in the target (FF). Thus, the pair involving 6 also has only ONE appropriately marked part of the repetition. The combination involving 7 contains two sentences that are related explicitly via a repeated argument, but the repetition does not satisfy the necessary antecedent-anaphor conditions. In 7, the room occurs as presupposed, while in the target that noun is focal (PF). Since neither occurrence of the repeated noun is marked appropriately, the PF set has no appropriate markings for successful integration (ZERO).

The foregoing illustrations suggest that the comprehensibility of the target sentence should vary as a function of the context conditions just outlined. Specifically, our interpretation of appropriately paired markings suggests that pairs involving TWOs (FP) ought to lead to faster comprehension than ONEs (FF and PP), which in turn should be faster than ZEROs (PF). These effects should obtain even though each of the pairs is connected by a repeated argument.

This paper reports two experiments that tested the ideas detailed above. Experiment I tested the hypotheses with active-voice sentence conditions, using a comprehension-time paradigm. Experiment II replicated Experiment I and also extended the findings to passive-voice expressions. Finally, rating data are presented to provide independent confirmation of the comprehension-time results.

EXPERIMENT I

Experiment I tested for an effect of reader expectation on comprehension of active-voice sentences. Alterations were made in the first (context) sentence of a pair, thereby varying the presuppositional-focal relations of a noun that was repeated across two sentences. For some sentence pairs, the presupposed information in the context was repeated as the presupposition in the target (PP). For others, the contextual presupposition recurred as a target sentence focus (PF). The third kind of sentence pair involved a contextual focus and a target presupposition (FP), and a fourth condition included a repeated noun with a focus-focus (FF) relation. Finally, we added a control condition in which no noun repetition (NR) occurred across the sentence pair.

The effect of expectation was tested by measuring the time required to comprehend the target sentence under the varying contextual conditions. The primary expectation predictions are clear. FP pairs should be comprehended faster than either FF or PP pairs, which in turn should be faster than PF pairs. In the PF case, however, the facilitative effect due to the repeated referent might be overshadowed by the *inappropriate linguistic relations.* Thus, it would not be unexpected if the PF combination was not facilitative at all in comparison with two disconnected sentences (i.e., NR).

Additionally, we included a control to rule out the possibility that the effects could be due to the mere proximity of the repeated noun. In active-voice sentences, the presupposition occurs early (e.g., the grammatical subject), whereas the focal elements occur near the end (e.g., the direct object in a simple transitive sentence). Thus, in sentence pairs, FP pairings have only a few words separating the repeated noun, whereas PF pairs have considerable distance between the noun repetition. In fact, a proximity explanation predicts the exact ordering of conditions as the expectation hypothesis. In this first experiment, half of the sentence pairs in each condition were written so as to keep constant the number of intervening words between the repeated noun. The remaining sentence pairs did not contain this constraint. One effect of wording control is to reduce the strength of the focal element by removing it from the sentence's end. This manipulation provides a rigorous test of the expectation hypothesis. If proximity rather than reader expectation accounts for the comprehension effects, then the proximity control will eliminate any ordering found in the uncontrolled condition.

Method

Materials and Design. Fifty sentence sets were constructed. Each set was comprised of five context sentences and a single target sentence. Coupling each context sentence with the target sentence resulted in pairs that satisfied the FP, FF, PP, PF, and NR conditions outlined earlier. The sets were constructed by five graduate students who were naive with respect to the theoretical aspects of the study. The students worked both independently and in a group.

Early in the sentence construction process, it became evident that some experimental pairs (specifically PF) were more difficult to create than others. Thus, the authors established the constraint that the most difficult conditions for each set be constructed before the remaining sentences in the set. So, for instance, FP sentence pairs were not written until there was group consensus that the PF representative was suitable. Sentences were written to convey a complete thought, and precautions were taken to preserve proper temporal sequencing of context and target events. All context sentences were active-voice declarative statements, and all had the general grammatical components of a main clause (The subject verbed the object) and two prepositional phrases (preposition a/the object). The repeated noun always appeared in the context sentence as the subject or object of the main clause. Typically, in active-voice sentences these two grammatical positions contain presupposed and focal information, respectively. Context sentences within each set were matched for numbers of words, propositions, arguments, and intrasentential argument repetitions. Target sentences were also active-voice statements and were of the grammatical form, "The subject verbed the object - prepositional phrase." All used either the subject or direct object as the anaphor. The only common information across any given context-target pair was the repeated noun.

Half of the sets were constructed so that a constant number of words separated the repeated noun regardless of the sentence condition ($\bar{X}$ = 7 words). This control was accomplished with the use of the two prepositional phrases and is typified by the example set in the upper portion of Table 1. Note, for instance, that the FP condition has the two phrases at the end of the sentence, whereas the PF condition sentence begins with the phrases. Although this manipulation alters the overall stress pattern of the sentences somewhat, it does not eliminate the presupposed and focal roles of the nouns of interest.

The remaining sentence sets were constructed without abiding by the proximity constraint. For those sets, the average number of words separating the noun repetition in the FP, FF, PP, and PF conditions were 4, 7, 7, and 10, respectively. A sample of a noncontrolled set is also given in Table 1.

Table 1

Example Sentence Sets Used in Experiment I

Proximity/ sentence condition	Text
Controlled	
FP	The noise aroused Merlin from a dream during the night.
FF	The shadow from the door protected the demon from exposure.
PP	In the laboratory, Merlin slammed the wand against the table.
PF	Despite the locks on the door, the demon stole the potions.
NR	The shadow from the door protected the potions from exposure.
TARGET	Merlin cast the demon from the castle.
Noncontrolled	
FP	During the riot, the warden sent the guard to the cell.
FF	During the riot, the warden spotted the prisoner with the gun.
PP	During the riot, the guard spotted the gun under the mattress.
PF	During the riot, the prisoner grabbed the gun under the mattress.
NR	During the riot, the warden sent the chaplain to the cell.
TARGET	The guard shot the prisoner in the chest.

For each subject, one context sentence was drawn from each of the 50 sets and paired with the target sentence to form 10 pairs of PF, FF, PP, PF, and NR sentences. Half of the sets for each sentence condition were controlled for proximity, and half were noncontrolled. The assignment of sets to sentence condition was varied across equal-sized groups of subjects according to one Latin square. Presentation order of the pairs was separately randomized for each subject.

Equipment and Reading Intervals. A Scientific Prototype two-field tachistoscope was used to present the sentence pairs. The subject controlled the initiation and termination of each trial. Pressing the foot switch brought the context sentence into the viewing field for a fixed amount of time, and then the target appeared automatically, replacing the context. The second sentence remained in view until the subject pressed a button. Comprehension time--from the onset of the target sentence to the button press--was measured by a Hunter Klockounter.

Since equipment constraints necessitated fixed timing of context sentences, preliminary testing determined the length of this reading interval. Ten undergraduates were recruited to read the context sentences. These norm subjects were tested individually, and each was told to read quickly but to take enough time to understand the sentence. Subjects were given 10 practice trials, followed by the 50 context sentences. Throughout the session, norm subjects initiated each reading interval with the foot switch and terminated the trial with the button press. Counterbalancing of contexts across subjects and sentence sets was identical to the procedure mentioned earlier. A two-factor analysis of variance (sentence condition by proximity) on reading times showed no differences among the contexts. The sentence condition means were 2,648, 2,627, 2,577, 2,636, and 2,613 milliseconds (msec) for FP, FF, PP, PF, and NR contexts, respectively ($p > .10$). Further, controlled (2,623 msec) and noncontrolled (2,618 msec) contexts did not differ, and there was no interaction of the two factors (both $F's < 1$). Therefore, the grand mean (2,620 msec) was selected as the fixed reading interval for context sentences.

Procedure. Individual testing of subjects also occurred in the main experiment. Subjects were told that the experimental task involved reading pairs of related sentences. Subjects were informed that the reading time was fixed for the first sentence of each pair, and all students were specifically instructed to report every incidence of insufficient reading time. The comprehension task itself was described to subjects with instructions similar to those of Haviland and Clark (1974). Subjects were told to read each first sentence carefully and completely because it was related to the second sentence of the pair. Further, subjects were told to read the second sentence as quickly as possible and to press the button when they understood what the second sentence meant in relation to the first. Subjects went through 60 total trials--10 practice and 50 test. The session lasted 50 minutes.

Subjects. The subjects were 27 undergraduate education majors at Arizona State University. Because of the fixed context reading interval, the criterion was established that subjects complete 90% of the trials without reporting insufficient reading time. Two subjects did not meet this requirement, and their data were not included in the analyses.

Results and Discussion

The comprehension times from the experiment are summarized in Table 2. Because the experiments used such a large sample of sentences for each condition, statistical analyses were used that allow generalization to other items as well as other subjects (Clark, 1973).

Table 2

Mean Target Comprehension Time (in milliseconds) as a Function of Proximity and Sentence Condition, Experiment I

Proximity	Sentence condition					Mean
	FP	FF	PP	PF	NR	
Controlled	1,594	1,691	1,784	1,903	1,933	1,781
Noncontrolled	1,664	1,734	1,810	1,836	1,891	1,788
Mean	1,629	1,717	1,797	1,869	1,912	

This procedure requires computations involving two analyses of variance--one analysis in which subjects are treated as the random effect and a second analysis in which the experimental sentences are used as the random effect. The ratios that result from these separate analyses are then combined to form the minimum estimate of a quasi F ratio, referred to as minF'. The formula for calculating minF' is

$$\text{minF}' = \frac{F_1 \cdot F_2}{F_1 + F_2}$$

where F_1 represents the F ratio in the subject analysis and F_2 is given by the corresponding F ratio in the item analysis. The degrees of freedom (i, j) are defined as

$$i = \text{number of groups minus one}$$

and

$$j = \frac{(F_1 + F_2)^2}{\left(\frac{F_1^2}{N_1} + \frac{F_2^2}{N_2}\right)}$$

where F_1 and F_2 are the F ratios for the subject and item analyses, and N_1 and N_2 refer to the denominator degrees of freedom in the subject and item analyses, respectively. Analyses of variance were computed using sentence condition (FP, FF, PP, PF, NR) and proximity (controlled, noncontrolled) as factors. In line with predictions, there was an effect for sentence condition, minF' (4,274) = 6.45, MSe_1 = .023, MSe_2 = .079, $p < .001$. There was no effect for proximity, and there was no interaction of proximity and sentence condition (both minF' < 1).

To make direct tests of the expectation predictions, we compared comprehension-time differences according to the number of appropriate markings contained in the sentence sets. TWO refers to sets in which the occurrence of the repeated noun was marked appropriately in each sentence of the pair (FP). ONE represents those sets in which only ONE sentence of the pair appropriately marked the noun of interest (FF and PP). Finally, ZERO refers to those sets that had a repeated argument, although neither sentence marked the concept appropriately (PF). Individual contrasts were performed using MSe_1 = .026 and MSe_2 = .053 as the pooled estimates of error for subjects and items, respectively (see Kirk, 1968, pp. 384-387). In line with our hypotheses, TWOs led to faster comprehension than ONEs, minF' (1, 143) = 5.10, $p < .05$, and ONEs were faster than ZEROs, minF' (1, 144) = 4.11, $p < .05$. These results demonstrate clearly that the linguistic markings of both context-sentence and target-sentence information influenced how easily two sentences could be integrated. When the noun of interest was marked appropriately in each sentence of the pair, as in the FP case, integration proceeded smoothly. Conversely, when the repeated noun was identified appropriately only once (in the context in FF and in the target in PP), or not at all (PF), comprehension became increasingly difficult. This pattern of effects held despite the proximity constraint. Thus, these data firmly supported the idea that readers use contextual information to guide their interpretation of subsequent content.

A final comparison between the PF and NR sentence conditions showed no differences, F_1 (1, 96) = 1.85, F_2 (1, 192) = .59, minF' < 1. This result suggests that the repetition of a concept does not guarantee facilitated comprehension of sentence pairs. When both occurrences of the repetition appeared in the inappropriate positions, integrating two sentences took as much time as integrating two disconnected statements.

Subjects reported insufficient reading time for contexts on only .012 of the trials. Nevertheless, we substituted adjusted cell means for these missing observations and repeated the analyses. None of the results changed significantly.

EXPERIMENT II

We have specifically hypothesized that the syntactically defined linguistic markings of the repeated noun are responsible for producing the expectation results. Experiment I affirmed this hypothesis using active declaratives. Obviously, however, the use of only one sentence type does not confirm the generality of the observed effects. Experiment II was therefore designed to replicate the results of Experiment I and extend them to another type of sentence, sentences in the passive voice.

Passives were chosen because they have several desirable properties for comparison with actives. First, passive transformations retain propositional invariance in relation to their active counterparts. This fact assures congruency of semantic content in the two sentence types. Second, one function of the passive transformation is to alter the linguistic markings of sentence elements (see Anisfeld & Klenbort, 1973). For instance, boy is presupposed in the active sentence, The boy hit the ball over the fence, whereas it is asserted in the passive expression, The ball was hit over the fence by the boy. In the realm of sentence pairs, a voice transformation of one sentence alters the pairing relation of a repeated concept. For instance,

Context: The pitcher threw the ball over the plate.

Active Target: The boy hit the ball over the fence.

Passive Target: The ball was hit over the fence by the boy.

The repetition of the ball in the pair using an active target has an FF (Focus-Focus) relation, whereas the pair using the passive target has an FP (Focus-Presupposition) marking set.

Experiment II used two target sentence types (active and passive voice) in combination with the five sentence conditions from the previous experiment (FP, FF, PP, PF, NR). Again, comprehension time was the measure of interest. If the expectation hypothesis is to be supported, the ordering of sentence conditions should be parallel for active and passive targets. That is, for each voice, FP pairs should be comprehended more quickly than FF or PP pairs, which in turn should be faster than PF pairs. Obviously, however, active targets should be comprehended more quickly than passives.

Method

Materials, Design, and Reading Interval. The materials from Experiment I were altered for Experiment II. The 50 sets of context sentences were changed in two ways. First, since the proximity control had no apparent effect, one prepositional phrase was deleted from each

context sentence, thereby reducing sentence length. Second, all context sentences were rewritten so that the grammatical structure was "The subject verbed the object--prepositional phrase." This change had the effect of making the linguistic pairing relations noncontrolled for the number of words that separated the noun repetition. (Note that the analogous condition in Experiment I produced the smallest expectation effects.) The 50 sentence sets were then randomly divided into two groups. Half the target sentences remained in the active voice, and the other half was transformed to the passive voice. Active targets averaged 7.56 words in length, and passives averaged 9.96 words. Samples of the resulting materials are provided in Table 3.

Table 3

Example Sentence Sets Used in Experiment II

Target voice/ sentence condition	Text
Active	
FP	The astronaut readied the craft for the descent.
FF	The scientists watched the landing on the screen.
PP	The craft relayed the data to the scientists.
PF	The landing represented a triumph for the scientists.
NR	The scientists watched the picture on the screen.
TARGET	The craft made the landing near the crater.
Passive	
FP	The lifeguard warned the diver about the current.
FF	The lifeguard spotted the shark from the shore.
PP	The diver photographed the eel beneath the boat.
PF	The shark noticed the movement in the water.
NR	The lifeguard scanned the coastline from the tower.
TARGET	The diver was attacked by the shark near the reef.

For each subject, a context-target pair was drawn from each set to make up 10 pairs in each FP, FF, PP, PF, and NR sentence condition. Half of these pairs had active target sentences, and half had passive. One Latin square was used to counterbalance sentence type and sentence condition across equal-sized groups of subjects. Presentation order of the sentence pairs was separately randomized for each student.

The context sentence reading interval was established in a manner identical to the earlier description, using 10 subjects for the norming. Again, no differences were observed in context sentence reading times, and the resulting fixed interval was set at the grand mean of 2,420 msec.

Procedure and Subjects. The procedure and instructions used in Experiment II were the same as those for Experiment I. Twenty-five undergraduates from the College of Education at Arizona State University volunteered for the experiment in return for extra class credit. All of the subjects met the 90% context reading criterion.

Results and Discussion

Table 4 summarizes target sentence comprehension times for the 10 experimental cells. As expected, active targets were read and understood more quickly than passives, minF' (1, 72) = 37.44, MSe_1 = .04, MSe_2 = .082, $p < .001$. This result replicates the well-documented active-passive difference (e.g., Gough, 1965; Savin & Perchonock, 1965) and thus requires no elaboration here.

Of prime interest was the effect for sentence condition, minF' (4, 269) = 10.73, MSe_1 = .02, MSe_2 = .061, $p < .001$, and the lack of an interaction between target voice and sentence condition, minF' < 1. Taken together, these general results support the robustness of the expectation effect for both active and passive sentences.

Table 4 shows that the predicted patterns of comprehension time conform closely to the observed orderings of the sentence conditions. To test specific predictions, comparisons between sentence conditions were made by considering the number of appropriate linguistic markings present in the sentence pairs (see Experiment I). The first prediction concerned the general replicability of the expectation results from the previous experiment, and was tested by comparing the overall sentence condition means. These contrasts showed that TWOs were integrated more quickly than ONEs, minF' (1, 143) = 10.84, $p < .001$, and ONEs were faster than ZEROs, minF' (1, 143) = 5.99, $p < .05$ (the error terms for these contrasts were MSe_1 = .019 and MSe_2 = .044). Thus, the idea that readers use linguistic markings to guide comprehension was reaffirmed in Experiment II.

Table 4

Mean Target Comprehension Time (in milliseconds) as a Function of Target Voice and Sentence Condition Experiment II

Target voice	Sentence condition					Mean
	FP	FF	PP	PF	NR	
Active	1,497	1,634	1,671	1,826	1,906	1,706
Passive	1,788	1,982	1,938	2,030	2,153	1,978
Mean	1,642	1,808	1,804	1,928	2,029	

The second prediction stated that the effects of linguistic markings would be parallel for active and passive targets. Part of the confirmation for this prediction was assured by the nonsignificant sentence condition by target voice interaction. Additionally, separate assessments were made for actives and passives by considering comprehension differences due to the number of appropriate markings in the sentence pairs. For active targets, the contrasts mirrored previous results; for TWOs versus ONEs, $\min F'(1, 142) = 4.93$, $p < .05$, and for ONEs versus ZEROs, $\min F'(1, 142) = 6.20$, $p < .05$. For passive targets, TWOs resulted in faster integration than ONEs, $\min F'(1, 142) = 6.06$, $p < .05$, but ONEs did not differ significantly from ZEROs despite the 70 msec difference in the right direction, $F_1(1, 48) = 3.61$, $F_2(1, 96) = 1.40$, $\min F' = 1.01$ ($MSe_1 = .018$ and $MSe_2 = .044$ for these contrasts). Failure to obtain this difference may have been due to a time-limit criterion that subjects use in a comprehension task like the present one. Suppose that subjects adopt an integration strategy that includes a "limited-time" memory search component. Logically, as sentence complexity increased (from active to passive) and appropriate markings decreased (from TWO to ZERO), identifying and comparing the repeated instances of the concept would require more search time. If a time limit was reached before the memory search was complete, subjects might resort to bridging or simply settle for incomplete comprehension. In bridging, there is no reason to assume that it takes less time to construct implicit propositions for passive ONEs than for passive ZEROs; thus ONEs would not differ from ZEROs. As far as incomplete comprehension is concerned, the least integratable pairs (passive ZEROs) would not differ from slightly more coherent expressions (passive ONEs) because of an attenuation effect. These possibilities would explain the present results and also provide additional meaning to the equivalence of PF and NR sentence conditions. As in the previous experiment, the present PF-NR conditions did not differ from each other; for actives, $\min F' < 1$, and passives $\min F'(1, 142) = 1.87$, $MSe_1 = .02$, $MSe_2 = .061$, $p < .10$.

The proportion of missing observations due to insufficient reading time was only .010. Analyses based on adjusted cell means did not alter the patterns of results reported above.

Before turning to a general discussion, we would like to consider the adequacy of comprehension time as a measure that accurately reflects the mental processes involved in comprehending sentences. Generally, comprehension time is seen as a rather subjective measure because of the lack of precision of the dependent variable. Subjects are free to interpret the instructions in several ways, thus using individual (uncontrolled) criteria for comprehension. Despite this subjectivity, comprehension time has now been used several times and has yielded consistent patterns of results (see Haviland & Clark, 1974; Yekovich & Walker, 1978; Singer, 1977). Furthermore, converging data have been reported (especially for Haviland & Clark's findings), using other dependent measures (e.g., Garrod & Sanford, 1977; Hupet & LeBouedec, 1977). Nevertheless, we decided to check the stability of our results by having people rate some of the sentence pairs from the second experiment. Sixty subjects were recruited to rate 50 pairs (5 from each of the 10 experimental conditions) according to the dimension of continuability. Continuability was defined to the subjects as "how easy it would be to write a third sentence that continued logically from the first two." The ratings were made on a 7-point scale, with 1 being difficult and 7 easy. The obvious expectation was that ease of comprehension would be reflected by high ratings of continuability.

Table 5 presents the results of those ratings according to the number of appropriate markings present in the pairs. NRs have also been included for comparison. It is clear from these data that subjects' ratings generally reflected the comprehension-time results of Experiment II. For actives, TWOs were rated as more continuable than ONEs, which were slightly higher than ZEROs. For passives, TWOs were higher than ONEs, but ZEROs were also slightly higher than ONEs, thereby showing a small discrepancy with the comprehension-time results. Finally, the low ratings of the NR conditions suggest that our subjects noticed the presence and absence of the repeated noun. Thus, this simple check provided additional confirmation of the comprehension-time results.

GENERAL DISCUSSION

The main finding of this study is that linguistic characteristics of both context and target information affect the integration of sentences. When common information was marked appropriately in each of the two sentences, comprehension was facilitated, whereas inappropriate markings in one or both sentences led to slower comprehension. These effects held when the proximity of the repeated information was controlled (Experiment I), and also when target sentences occurred in either the active or the passive voice (Experiment II). Since most psycholinguists would agree that actives and passives are "weak" with

respect to presupposition-assertion relations (e.g., Bock, 1977; Hornby, 1974), this latter result provides especially strong evidence for the expectation effect.

Table 5

Mean Continuability Ratings for 50 Sentence Pairs in Experiment II, as a Function of Target Voice and Number of Appropriate Markings

Target voice	Number of markings				
	TWO	ONE	ZERO	NR	Mean
Active	5.87	4.97	4.86	3.38	4.91
Passive	5.71	5.10	5.20	4.48	5.11
Mean	5.79	5.04	5.03	3.93	

Note: Each mean is based on 300 observations.

The effects of reader expectation found in these experiments can be fit comfortably into the notion of the "discourse pointer" (Carpenter & Just, 1977). According to Carpenter and Just, a discourse pointer is a mental symbol that designates the current topic of a text. Sentence integration involves relating incoming information to that designated memory representation. Since this relational process is influenced by the linguistic structure of the incoming information, Carpenter and Just contended that "information marked as old in the [incoming or target] sentence should usually correspond to the contents of the pointer" (1977, p. 220). In support of this idea, Carpenter and Just presented data showing that target sentences took longer to integrate when the repeated information in the target sentence was marked inappropriately (as new) than when it was marked appropriately (as old).

This study has viewed sentence integration as involving pairs of linguistic markings of the information common to both context and target sentences. This idea maintains that readers identify linguistically marked candidate information in the context sentence, expecting to use it in understanding the target. In the absence of other linguistic cues, the most likely candidate antecedent is contextual information marked as new. Additionally, the linguistic marking of the anaphor presupposes the existence of a direct antecedent (Haviland & Clark, 1974), and thus the important integrative information in the target should ideally be old. Consequently, integrating two sentences is simplified when the common information across the pair is introduced as new (focal) and then repeated as old (presupposed). The results of

both experiments clearly support this interpretation and further show that when important information was mismarked in the context sentence, comprehension difficulties arose. Thus, the present experiments show that the linguistic marking of contextual information is one way to determine an initial setting for the discourse pointer. Put simply, the linguistic markings in the context sentence allow the reader to mentally set the pointer to information deemed topically important.

An idea closely related to the discourse pointer construct concerns the temporal nature of integrative processing. Research has generally implied that target information necessary for integration is identified first and then memory is searched for any matching antecedent (e.g., Haviland & Clark, 1974). This view has two interdependent implications. First, sentence integration is presumably a backward process (i.e., from target to context or input to memory); second, all context information in memory is equally accessible as a direct antecedent. The present results clearly disconfirm the second implication. Suppose that integrating two sentences is backward in nature and further that all context information in memory is equally accessible. Since the old information in the target is the important integrative agent, that information will be identified and memory will be searched for any antecedent. According to this logic, presupposed information in the context sentence is as accessible as the contextual focus and thus search time in memory should be comparable for each kind of marked information. As a consequence, comprehension time should not vary as a function of contextual marking. In terms of this study, FP and PP conditions should not differ. However, the data in Tables 2 and 4 present a different result. FP and PP conditions took reliably different amounts of time to comprehend. At the minimum, these results imply that if sentence integration is a backward operation, all contextual information in memory is not equally accessible. A modified backward process could be hypothesized, however, by invoking a spreading activation assumption (Collins & Loftus, 1975). That is, it would be reasonable to claim that linguistic markings control the amount of activation a concept receives when it is processed for memory storage. Logically, when context information is input, new information would receive greater activation than old information. Consequently, when the given information in the target is identified, and the memory search initiated, the contextual focus would have a greater probability of access than the contextual presupposition due to greater activation. This access difference would lead to accurate predictions about the comprehension of FP and PP pairs.

Essentially, the linguistic effects demonstrated here have shown how linguistic markings affect the introduction and subsequent elaboration of a single concept. In our experiments the only common information across the two sentences was a single noun, as opposed to several repeated concepts or propositions. Thus, the present studies have provided a test of sentence integration where two sentences are minimally connected. As already mentioned, this fact may have attenuated the linguistic effects, since subjects may have reverted to

bridging or incomplete comprehension. Conditions beyond minimal connectedness provide a much more complex issue, and as a result may alter subjects' strategies for integrating information. For instance, the amount of repeated information across sentences may modify how linguistic operators are used to identify antecedents and anaphors.

Finally, our experiments have viewed integration within a two-sentence framework. One immediate question to be answered concerns how linguistic operators function in extended text. For example, when repeated information occurs over several sentences, are there patterns of linguistic markings that underlie the repetition?[5] Such questions deserve empirical attention as they are prerequisite to a complete understanding of the integrative process.

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[5] Manelis (1978) has studied the sequencing of propositions connected to each other by repeated concepts. His research shows that the sequence of connections is important in both comprehension of and memory for text. One can interpret his sequence effects in terms of linguistic patterns of connections.

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ARI Distribution List

4 OASD (M&RA)
2 HQDA (DAMI-CSZ)
1 HQDA (DAPE-PBR)
1 HQDA (DAMA-AR)
1 HQDA (DAPE-HRE-PO)
1 HQDA (SGRD-ID)
1 HQDA (DAMI-DOT-C)
1 HQDA (DAPC-PMZ-A)
1 HQDA (DACH-PPZ-A)
1 HQDA (DAPE-HRE)
1 HQDA (DAPE-MPO-C)
1 HQDA (DAPE-DW)
1 HQDA (DAPE-HRL)
1 HQDA (DAPE-CPS)
1 HQDA (DAFD-MFA)
1 HQDA (DARD-ARS-P)
1 HQDA (DAPC-PAS-A)
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1 HQDA (DAMO-RQR)
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